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Development of Process Technology for Two-stage Enzymatic FAEE-biodiesel Production

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Fatty acid ethyl ester (FAEE) biodiesel production catalyzed by immobilized lipases is attracting considerable interest as an alternative to conventional base-catalysed biodiesel production, due to its potential of improved sustainability[1]. However, FAEE has thus far not been a well recognized biodiesel product and the high cost of the immobilized lipases has limited its commercial application[2]. Here, we present a two-stage biodiesel production, catalyzed by two immobilized lipases in two reactors, which aims to make FAEE-biodiesel qualified for the market in terms of specifications and to enhance the economic viability for large-scale industrial application by improving the process efficiency.

For the first stage of the process (transesterification of glycerides), the activity and stability of the catalyst have been evaluated in a stirred tank reactor with respect to the effects of mechanical stirring and ethanol concentration. In the second stage (esterification of fatty acids), catalyst performance has been evaluated in a packed bed reactor, focusing on the effect of the by-product water.

[1] Nielsen, P.M., Brask, J., Fjerbaek, L., 2008. Enzymatic biodiesel production: Technical and economical considerations. Eur J Lipid Sci Technol 110, 692–700.

[2] Fjerbaek, L., Christensen, K.V., Norddahl, B., 2009. A review of the current state of biodiesel production using enzymatic transesterification. Biotechnol Bioeng 102(5), 1298-1315.